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GB A 2129126 GB 1532834 GB 1514350
GB 1456690 GB 0825243 GB 0671377

(58) Field of search
G1N
G1A.

(54) **Measuring dimension of articles on a conveyor system**

(57) A dimensional measurement piece of equipment consisting of sensors positioned about the conveyor system providing electrical input signals to a computer by means of an Input/Output Interface. For width/height measurement an Encoder is used as one of the sensors to provide pulse signals.

For length the various time intervals are measured and recorded to enable simultaneous determination of the true velocity at which products are travelling and the time it takes for the products to pass particular sensors, e.g. A & B. An inclined sensor C permits height measurement.

For width/height, the various pulses and time intervals are measured and recorded to enable simultaneous determination of the number of pulses for the lateral movement of sensors and the time it takes for the products to pass particular sensors.

The information is converted to dimensional measurements for continuously up-dated display as Numerical and Graphical Data on a screen monitor.

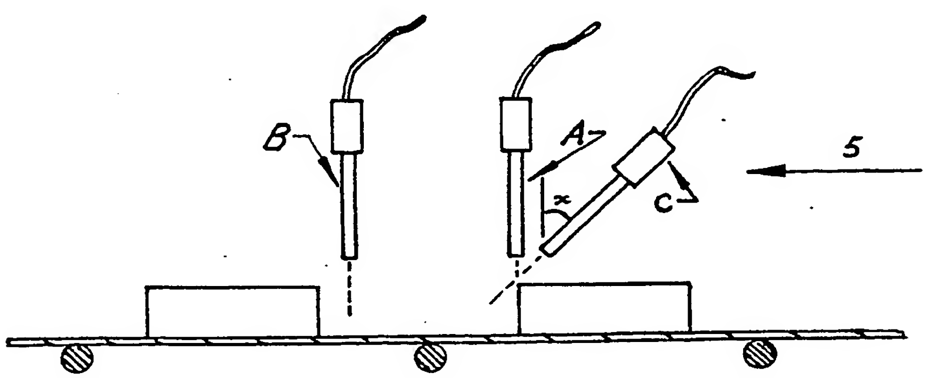

FIG 2

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D F /

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DRAWING 1/5

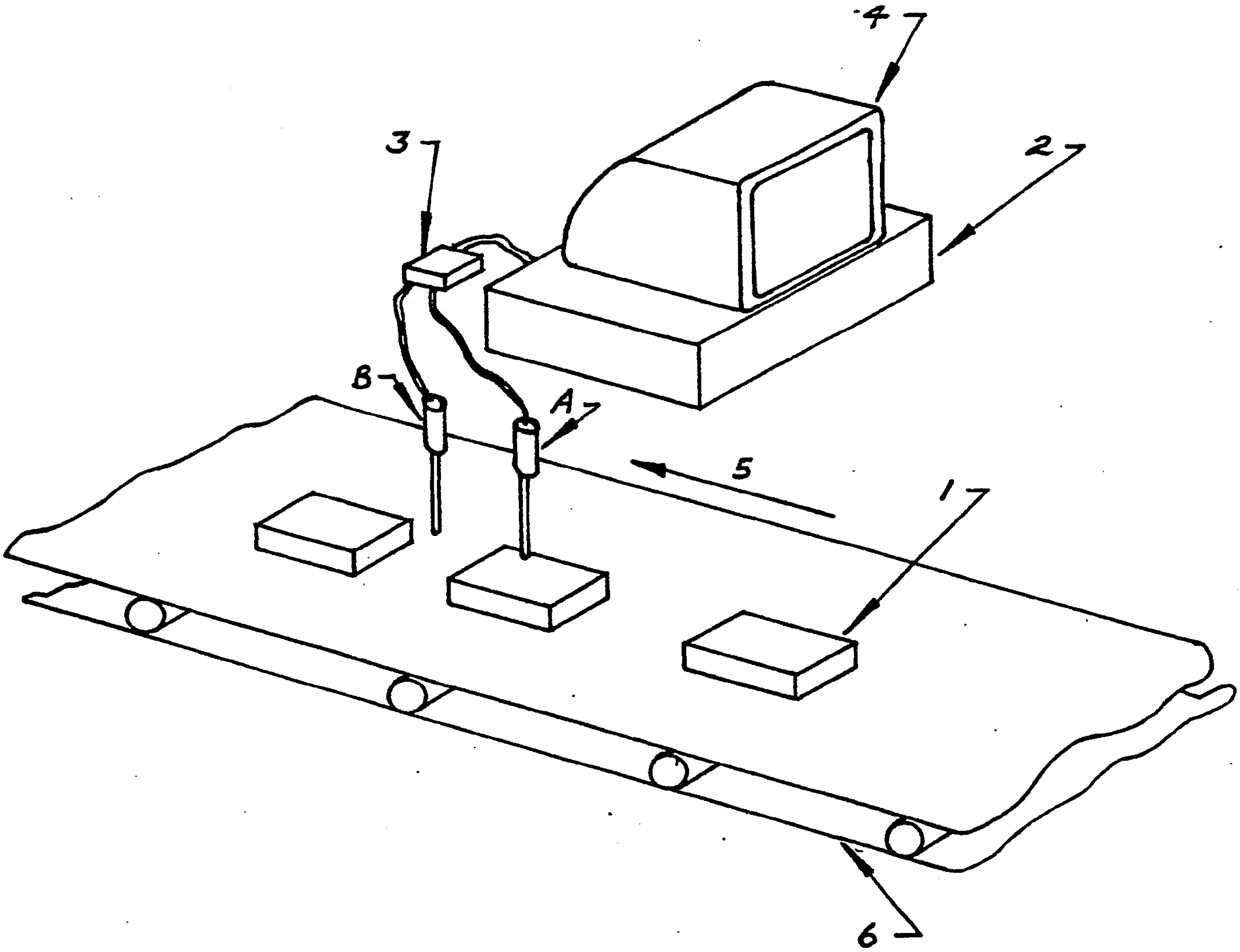

FIG 1

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D F A

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DRAWING 2/5

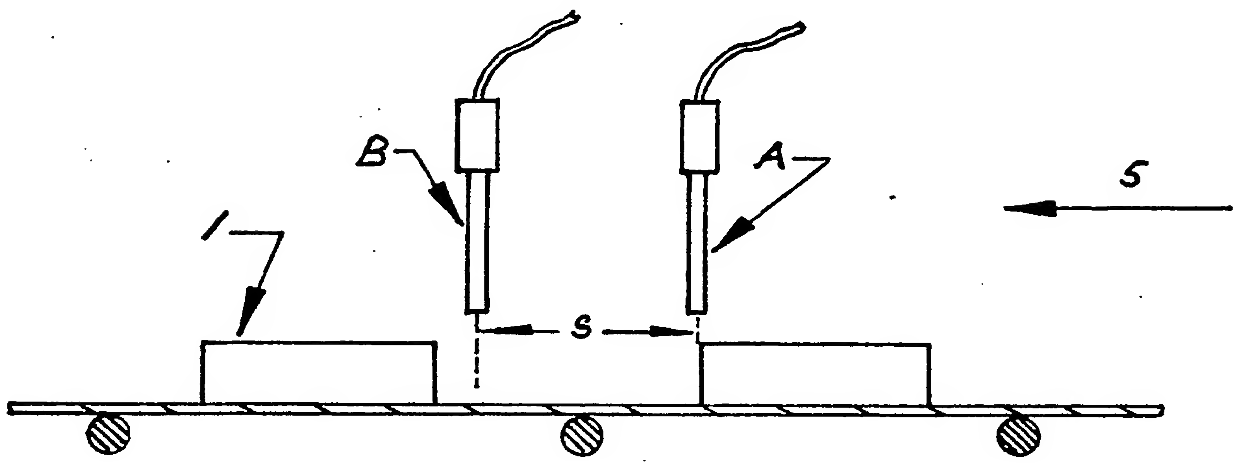

FIG 1

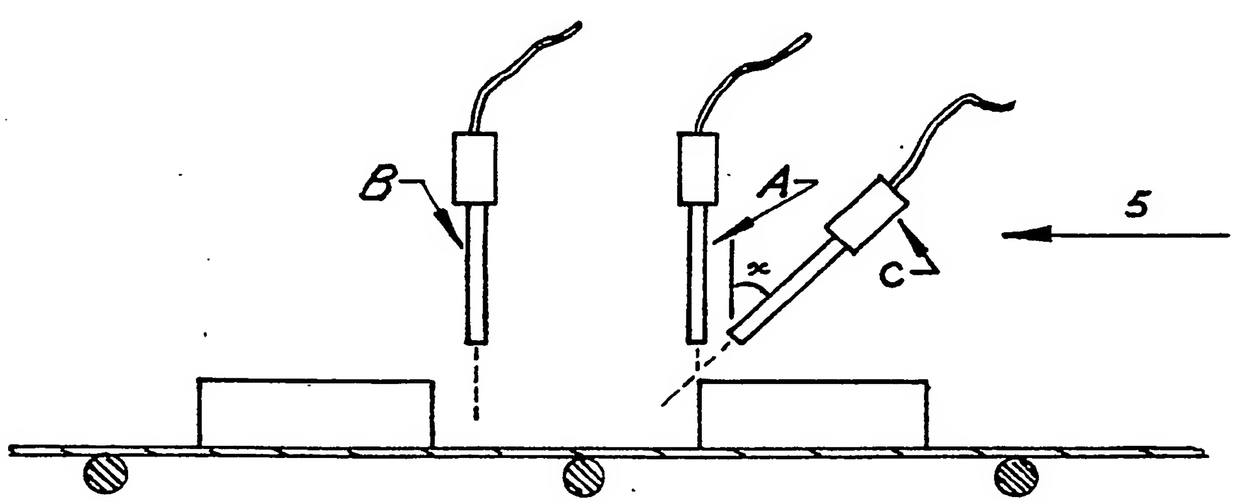

FIG 2

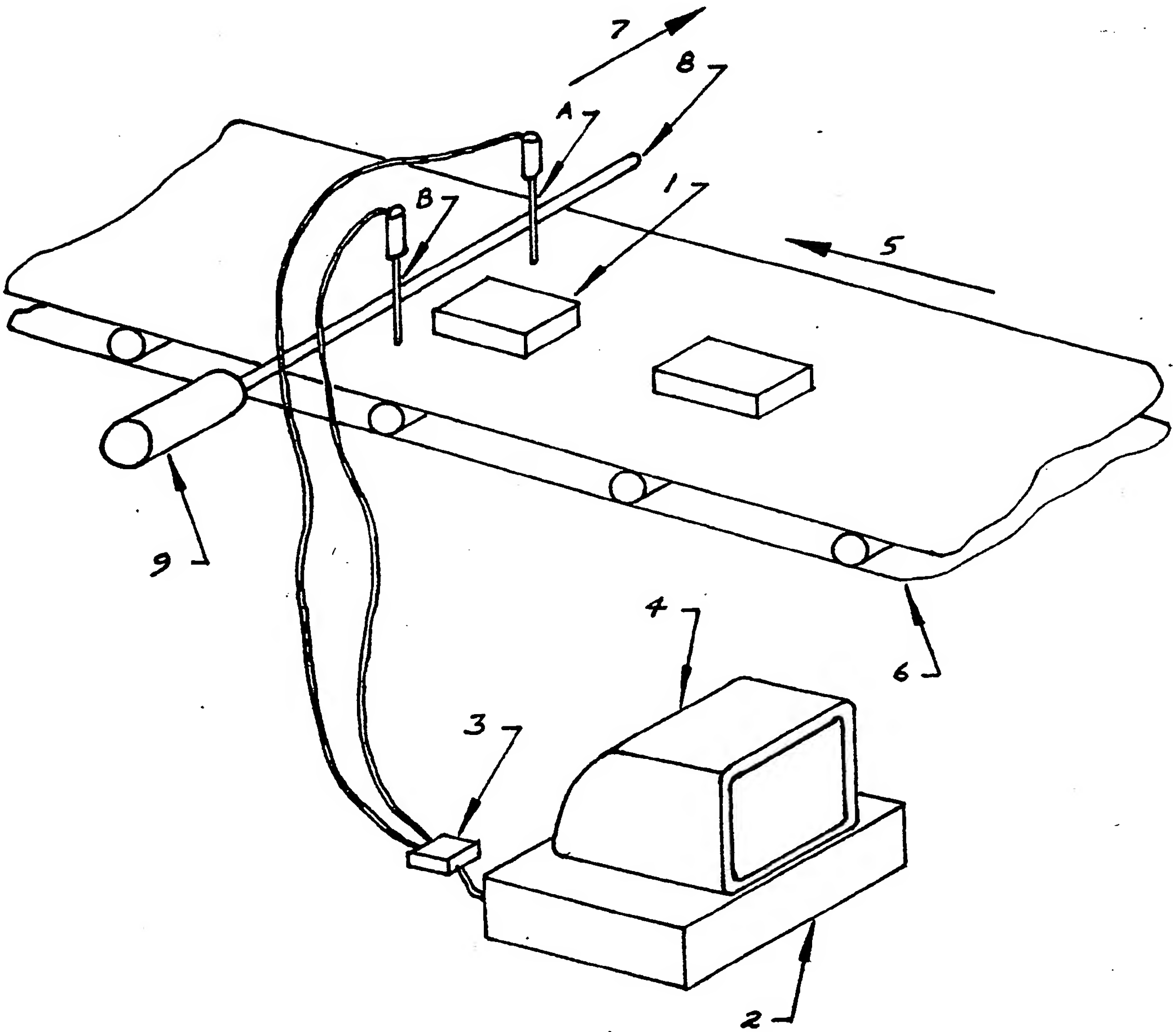

FIG 1

DRAWING 4/5

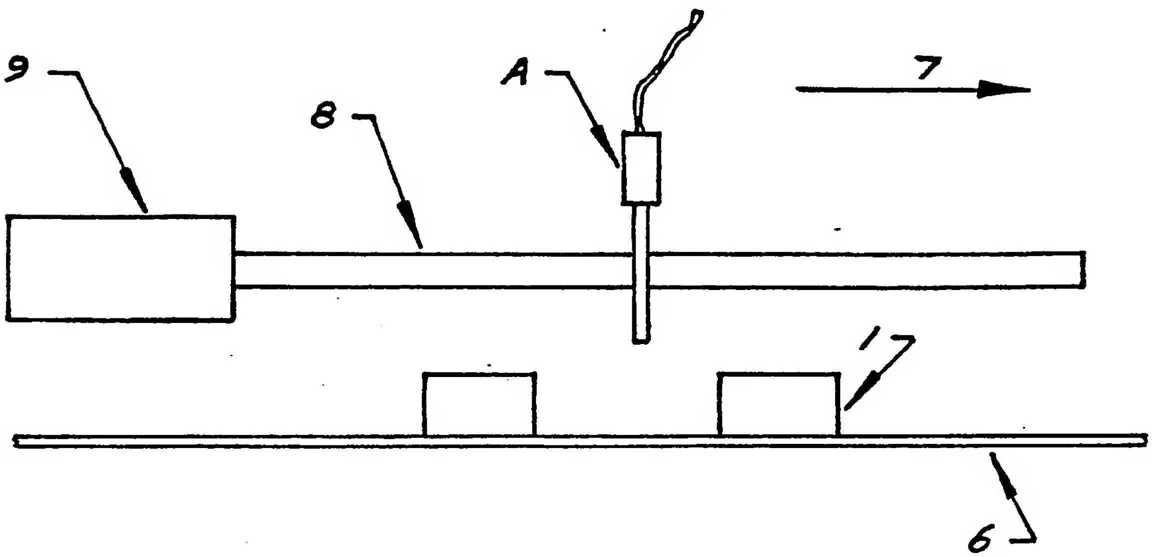

FIG 1

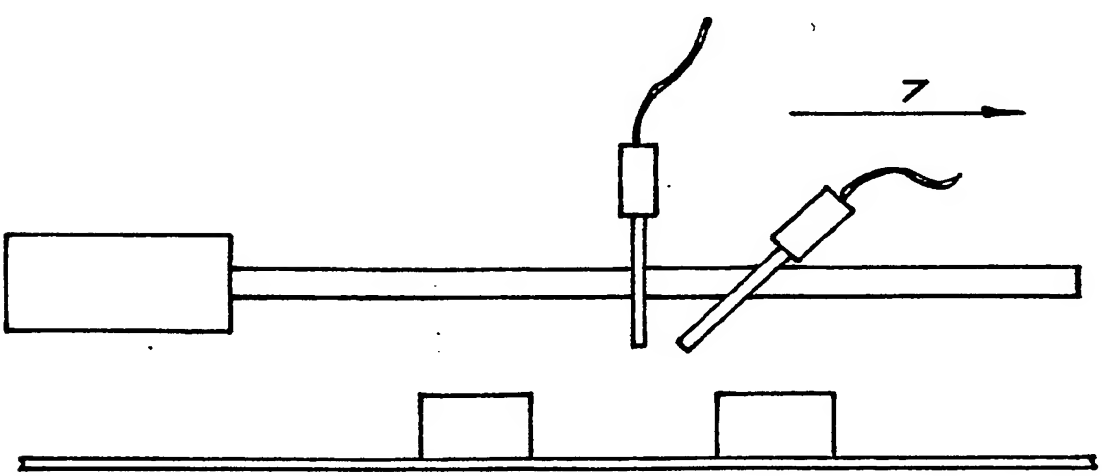

FIG 2

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DFA

DRAWING 5/5

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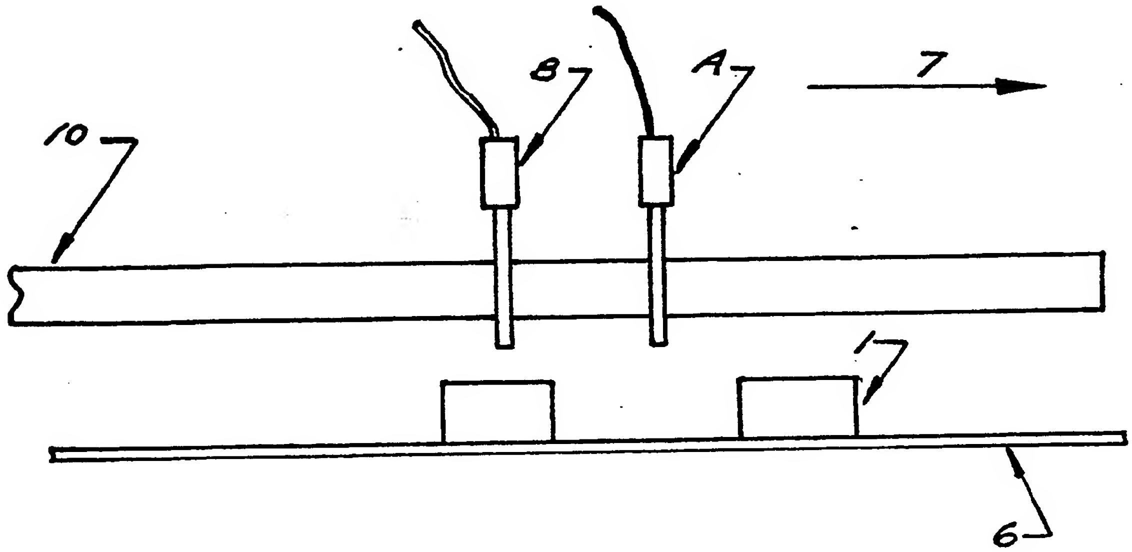

FIG 1

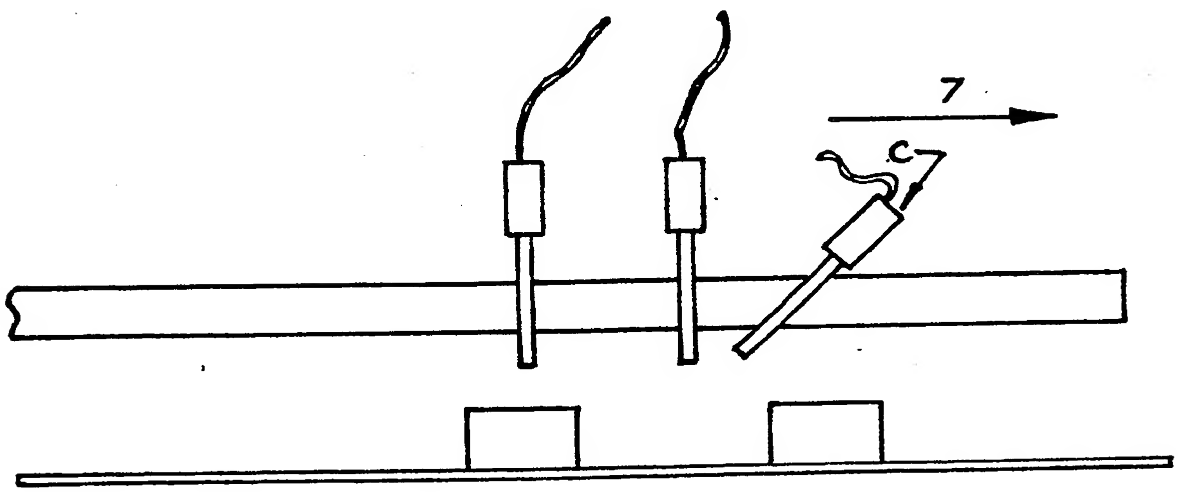

FIG 2

"PDU-1 SCANNER"

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This invention relates to the dimensional measurement of moving objects.

Dimensional measurement, for Data purposes, of products on moving conveyor systems can be performed either manually, by removal of the product and measuring it physically, or by some method of detection to enable calculations of dimensions to be determined whilst the product is still on the moving conveyor system.

A length detection system commonly utilises a sensor for measuring the "time" taken for the product to pass the sensor and then directly converting this "time" period and displaying it as a length measurement. The principle of calibration of "time" to represent "length" will only be true if the conveyor system speed remains the same for each of the products measured.

In practice, however, conveyor system speeds are not constant and are influenced by many factors, including those resulting from any mechanical and/or electrical properties of associated equipment. Once a measuring system has been calibrated for a specific conveyor speed, a product travelling more slowly results in a longer time for it to pass a sensor and would therefore "appear" longer in length in any calculations. Conversely, the faster the product passes a sensor the shorter in length it would "appear".

According to the present invention the PDU-1 Scanner for length/height measurement consists of rigidly mounted sensors, positioned about the conveyor system, to provide electrical input signals to a computer by means of an Input/Output Interface. Utilising these signals the computer measures and records the necessary information to enable simultaneous determination of the true velocity at which products are travelling and the "time" it takes for the products to pass particular sensors.

Using this information the true length of the product can be calculated regardless of any increase or decrease in actual speed of the conveyor system.

Drawing 1/5 Figure 1 shows in perspective a general installation of the PDU-1 system with sensors positioned over a conveyor system for the measurement of length.

Drawing 2/5 Figure 1 shows the detailed position of sensors relative to the product and conveyor system for the measurement of length.

Drawing 2/5 Figure 2 shows the detailed position of sensors relative to the product and conveyor system for the measurement of length and height.

Drawing 3/5 Figure 1 shows in perspective a general installation of the system with sensors positioned about a conveyor system for the measurement of width.

Drawing 4/5 Figure 1 shows the detailed position of sensors, one being a Shaft Encoder, relative to the product and conveyor system for the measurement of width.

Drawing 4/5 Figure 2 shows the detailed position of sensors, one being a Shaft Encoder, relative to the product and conveyor system for the measurement of width and height.

Drawing 5/5 Figure 1 shows the detailed position of sensors, one being a Linear Encoder, relative to the product and conveyor system for the measurement of width.

Drawing 5/5 Figure 2 shows the position of sensors, one being a Linear Encoder, relative to the product and conveyor system for the measurement of width and height.

A specific embodiment of the invention for measurement of length dimensions will now be described by way of example with reference to the accompanying Drawing 1/5 Figure 1 and Drawing 2/5 Figure 1 in which:-

Sensor A and Sensor B are set a known distance 'S' apart above the product 1. The line between sensor A and sensor B is on an axis parallel to that of the direction in which the product is moving, indicated by arrow 5, on the conveyor system 6.

When the leading edge of the product passes under sensor A, it switches sensor A "high" and provides a signal, by means of the Input/Output Interface 3, to start an internal clock in the computer 2. When the leading edge of the product passes under sensor B, it switches sensor B "high" and provides a signal, by means of the Input/Output Interface 3, to enable the computer program to return a time value for the program variable A% (ie A-high to B-high).

When the trailing edge of the product passes under sensor A it switches sensor A "low" and stops the internal clock in the computer. The computer program returns a time value for the program variable B% (ie A-high to A-low).

By measuring the time interval (A%) it takes for the product to travel the known distance from sensor A to sensor B the true velocity of the product (i.e. the velocity of the conveyor system) can be calculated in terms of distance(mm)/time(sec) i.e. S/A%.

Knowing the "time" value B% it takes for the product passing sensor A, the length can be calculated. By equating the ratios, compensation is made should there be any increase or decrease in speed of the conveyor system. The length can be calculated as follows:-

$$\frac{\text{distance 'S'}}{\text{A\%}} = \frac{\text{length 'L'}}{\text{B\%}}$$

Therefore: length 'L' = distance 'S' x (B%/A%)

In the case of width/height measurement, the PDU-1 Scanner includes the use of an Encoder, as illustrated in Drawing 4/5 Figure 1, as one of the sensors positioned about the conveyor system to provide pulses for lateral movement velocity calculations.

The information is converted to dimensional measurements for continuously up-dated display as Numerical and Graphical Data on a screen monitor 4.

The attached listing shows the basics of the computer program. The main body of the program is listed between lines 200 and 370.

200 Draws the screen text display for the main heading and headings for the calculated figures. Draws the axis for the graphics display in the lower part of the screen.

220 Resets all variables.

270-290 Samples each set of sensors in turn for one minute to obtain values A% and B%.

300 Control for minute update.

310 Updates the screen clock, moves the minute figures down one position in the array and calculates all minute figures.

320 Plots the new graph positions and prints out current minute figures.

330 Control for hourly update.

340 Updates the clock and calculates the hourly figures. Prints hourly figures and resets variables.

350 Control for 24 hour period.

CLAIMS

1 According to the present invention the PDU-1 Scanner is a dimensional measurement piece of equipment for length measurement consisting of rigidly mounted sensors, positioned about the conveyor system, to provide electrical input signals to a computer by means of an Input/Output Interface. Utilising these signals a computer measures and records the various time intervals to enable simultaneous determination of the true velocity at which products are travelling and the time it takes for the products to pass particular sensors. This information is converted to dimensional measurements for continuously up-dated display as Numerical and Graphical Data on a screen monitor.

2 A PDU Scanner as claimed in Claim 1, wherein a sensor C is mounted at a known angle 'x' relative to that of the other sensors to measure height dimensions. Reference Drawing 2/5 Figure 2.

3 A PDU Scanner as claimed in Claim 1, wherein the sensors travel by means of a traverse unit in the direction of arrow 7, at right angles to the direction of the travel of the product, indicated by arrow 5, to measure width. Lateral movement of the traverse unit 8 is measured in terms of pulses using a Shaft Encoder 9. Reference Drawing 3/5 Figure 1 and Drawing 4/5 Figure 1.

4 A PDU Scanner as claimed in Claim 1 & Claim 3 wherein a sensor C is mounted at a known angle 'x' relative to that of the other sensors to measure the height. Reference Drawing 3/5 Figure 1 and Drawing 4/5 Figure 2.

5 A PDU Scanner as claimed in Claim 3 or Claim 4, wherein a Linear Encoder is used instead of a Shaft Encoder. Reference Drawing 5/5 Figures 1 & 2.

6 A PDU Scanner as claimed in any preceding claim, wherein a number of PDU Scanners are linked together providing a Network facility.

7 A PDU Scanner as claimed in any preceding claim, wherein the computer will be a single card unit.

8 A PDU-1 Scanner substantially as described herein with reference to the accompanying Drawings 1/5, 2/5, 3/5, 4/5 and 5/5.